ENGINEERING SOILS MAP OF VERMILLION COUNTY, INDIANA

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BY

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JHRP

JOINT HIGHWAY RESEARCH PROJECT

PURDUE UNIVERSITY AND

INDIANA STATE HIGHWAY COMMISSION

Final Report

ENGINEERING SOILS MAP OF VERMILLION COUNTY, INDIANA

TO: J. F. McLaughlin, Director
Joint Highway Research Project

September 7, 1972

Project: C-36-51B

FROM: H. L. Michael, Associate Director
Joint Highway Research Project

File: 1-5-2-52

The attached report entitled "Airphoto Interpretation of Engineering Soils of Vermillion County, Indiana", completes a portion of the project concerned with development of county engineering soils maps of the state of Indiana. This is the 52nd report in the series. The report was prepared by Dr. P. T. Yeh, Research Engineer, Joint Highway Research Project.

The soils mapping of Vermillion County was done primarily by airphoto interpretation. Some test data along SR 63 are included in the report. Generalized soil profiles of the major soil for each land form are presented on the engineering soils map. An ozalid print of the engineering soils map of Vermillion County is included in the report.

Respectfully submitted,

Harold L. Michael

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Research Engineer

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Conducted by

Joint Highway Research Project
Engineering Experiment Station
Purdue University

In cooperation with

Indiana State Highway Commission

Purdue University
West Lafayette, Indiana
September 7, 1972

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The author wishes to acknowledge the assistance given by all those persons who have helped in the preparation of this report. Special acknowledgments are due the members of the advisory board Joint Highway Research Project for their active interest in furthering the study; Professor H. L. Michael, Associate Director, Joint Highway Research Project for review of the report; Professor R. D. Miles, in charge of the airphoto interpretation and photogrammetry laboratory for review and suggestions, Professor D. G. Shurig Research Associate, Joint Highway Research Project for his valuable help.

All airphoto used in connection with the preparation of this report automatically carried the follwoing credit lines: photographed for commodity stabilization service, performance and aerial photography divisiion, United States Department of Agricutlure.

AIRPHOTO INTERPRETATION OF ENGINEERING SOILS OF VERMILLION COUNTY, INDIANA

by

P. T. Yeh

INTRODUCTION

The Engineering Soils Map of Vermillion County, Indiana which accompanies this report was compiled from 7 in. x 9 in. aerial photographs having an approximate scale of 1:20,000. The aerial photographs were taken in July 1938 for the United States Department of Agriculture and were purchased from that agency.

Aerial photographic interpretation of the land forms and engineering soils of this county was accomplished in accordance with accepted principles of observation and inference (1)*. Field trips were made to the area for the purposes of resolving ambiguous details and correlating aerial photographic patterns with soil textures. Standard mapping symbols developed by the staff of the Airphoto Interpretation Laboratory, School of Civil Engineering, Purdue University, were employed to delineate land forms and soil textures. The text of this report largely represents an effort to overcome the limitation imposed by adherence to a standard symbolism and map presentation.

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*Numbers in parentheses indicate references in the bibliography.

Although no soil samples were collected and tested by the Joint Highway Research Project, general soil profiles were developed and are shown on the soils map. The soil profiles were compiled from the agriculture literature, information from adjacent counties, and from the boring data of the roadway soil survey along SR 63 supplied by the State Highway Commission. Liberal reference was made to: "The Formation Distribution and Engineering Characteristics of Soils" (2), "Soil Survey of Vermillion County, Indiana" (3), "Vermillion County Soils" (4), "Edgar County Soils" (5), and the Engineering Soils Map of Warren and Vigo Counties, Indiana (6,7).

DESCRIPTION OF AREA

General

Vermillion County lies along the western boundary of Indiana, about midway between the northern and the southern State boundaries (Figure 1). Vermillion County is long and narrow - its east-west dimension ranges from five to eight miles and its north-south dimension is about 38 miles. The Wabash River is the natural eastern boundary of the county. The total area of Vermillion County is 263 square miles or 168,320 acres (8).

Newport is the county seat located near the Wabash River and about midway between the northern and the southern county boundaries. A population of 16,793 inhibitants resided within the county at the time of the 1970 census - of those 5,340 live in the city of Clinton (9).

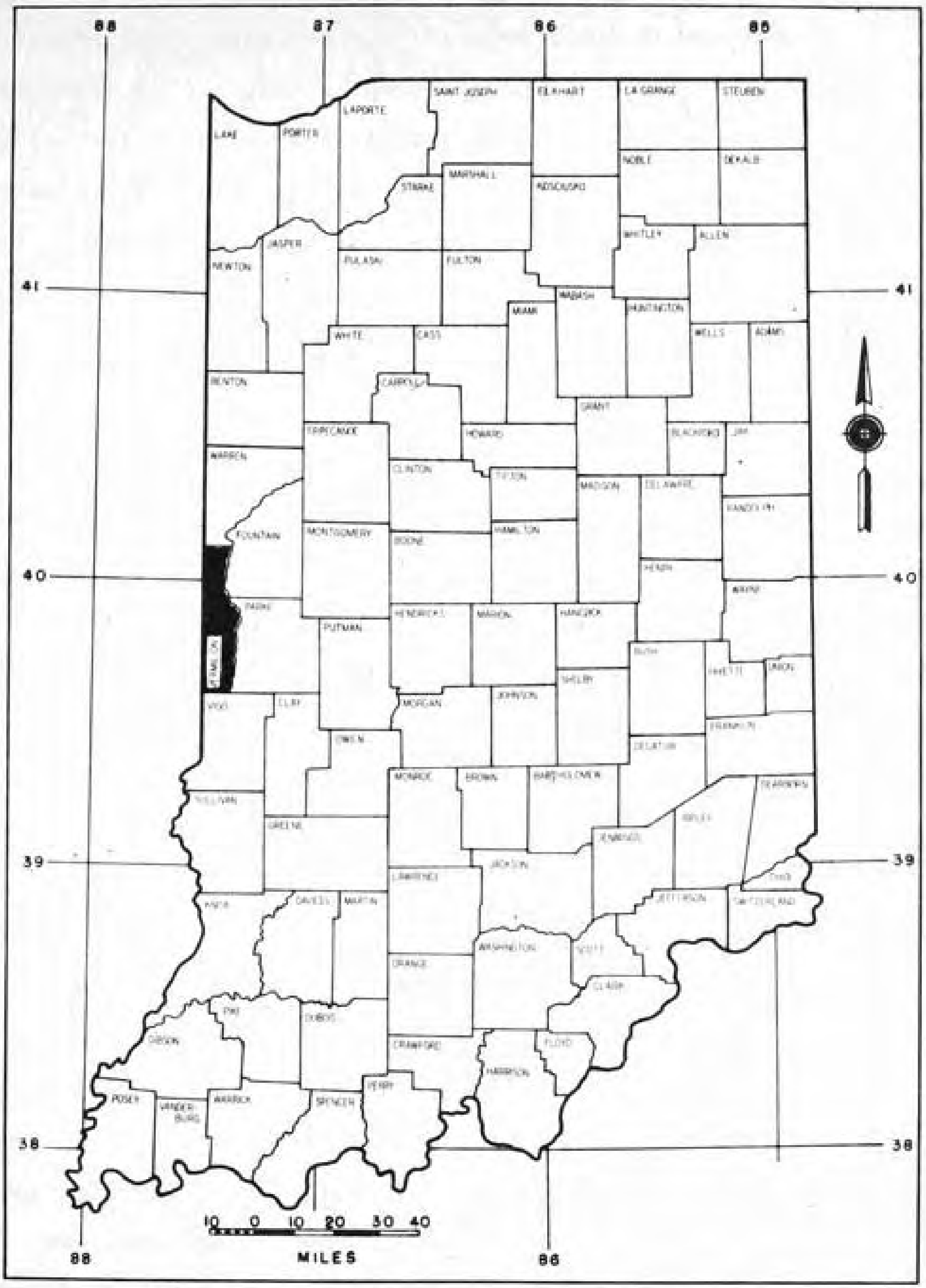


FIG. I LOCATION MAP OF VERMILLION COUNTY

According to the 1964 census of Agriculture, 79.1 percent of Vermillion County, or 133,171 acres, was farmland (8). There were 9,767 acres of woodland in the county (8), which was generally confined along the bluffs or the valleys of the major streams and rivers as shown in Figure 2. With the ever increasing strip mining activity the acreage of farm land and timber land is being reduced accordingly.

Drainage Features

Vermillion County lies wholly within the drainage basin of the Wabash River (Figure 3). All the drainage flows in the easterly direction toward the Wabash River. The Wabash River flows in a preglacial valley in a southerly direction. The valley of the Wabash acted as a glacial sluiceway during the glacial period. Large terrace deposits were formed on both sides of the river.

Vermillion River is the major river within the county. The largest portion of this watershed is within the State of Illinois but some waters are collected from Warren and Benton counties of Indiana. The Little Vermillion River and Brouilletts Creeks collect their head waters in Illinois before entering the county.

Spring Creek, Jordan Creek, Little Raccoon Creek, Norton Creek and Feather Creek are small tributaries of the Wabash River with their head waters within the county.

Many streams, especially the Vermillion River and Little Vermillion River, flow on rock in portions of their courses. The effect of rock control is exhibited by the angular bends of the streams shown in Figure 3.

FIG 2 AIRPHOTO MOSAIC OF VERMILLION COUNTY, INDIANA

FROM 1939 INDEX MAP

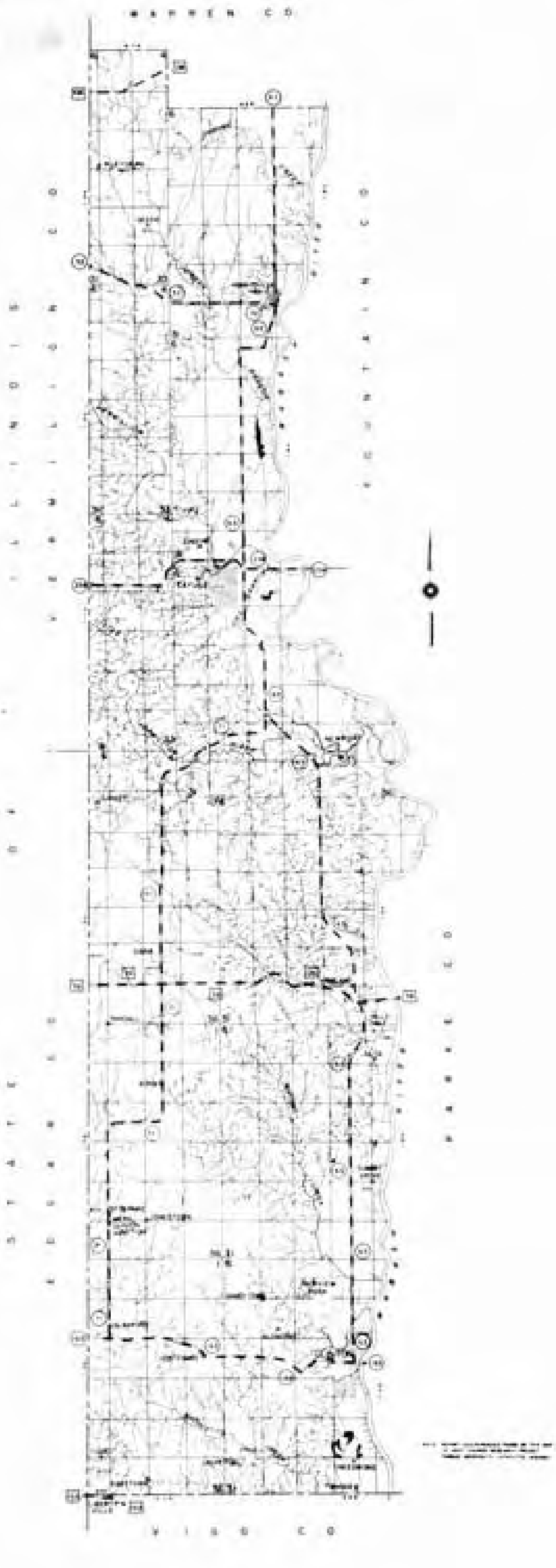


FIG. 3

DRAINAGE MAP

VERMILLION COUNTY

INDIANA

PREPARED FROM
1940 AAA AERIAL PHOTOGRAPHS
BY
JOINT HIGHWAY RESEARCH PROJECT
AT
PURDUE UNIVERSITY
1952

Fine-textured drainage patterns are developed on the morainic areas. There are no natural lakes in Vermillion County. Ponds of various origins are scattered throughout the area. Most of the ponds are the product of strip mining or are stock ponds. Ditches have been constructed to improve drainage conditions in the nearly level areas in the prairie plains and the basins.

Climate

The climate of Vermillion County is continental, humid and temperate. The warm humid and moderately cold winters are characterized by frequent sudden changes of temperatures. Precipitation is rather evenly distributed throughout the year.

There is no weather station in Vermillion County. The nearest weather station is at Rockville in Parke County - a few miles east of the county. The annual precipitation taken from a 30-year mean (1934 to 1963) is about 41 inches with an expected average snowfall of 23 inches (10). The average mean maximum and minimum temperature and mean precipitation, collected from 1934 to 1963, is listed in Table 1.

Physiography

Vermillion County lies wholly within the Tipton Till Plain of the State (Figure 4). With Respect to its physiographical situation in the United States, Vermillion County is a part of the Till Plain Section of the Central Lowland Province (11).

Table 1. AVERAGE TEMPERATURE AND PRECIPITATION IN ROCKVILLE INDIANA FROM 1934 TO 1963

	Temperature			Precipitation
Month	Mean(°F)	Average Max. (°F)	Average Min. (°F)	Mean (Inches)
Jan.	29.0	37.1	20.8	2.76
Feb.	31.0	40.4	23.1	2.44
Mar.	41.1	50.6	31.5	3.78
Apr.	52.7	63.3	42.1	3.81
May	61.3	74.4	48.2	4.86
June	72.7	83.9	61.5	5.24
July	76.3	87.7	64.8	3.78
Aug.	74.8	86.1	63.5	3.32
Sept.	67.2	78.9	55.5	2.86
Oct.	57.1	68.7	45.5	2.84
Nov.	42.2	51.3	33.0	3.04
Dec.	31.4	39.2	23.5	2.36
Annual	53.2	63.5	42.8	41.09

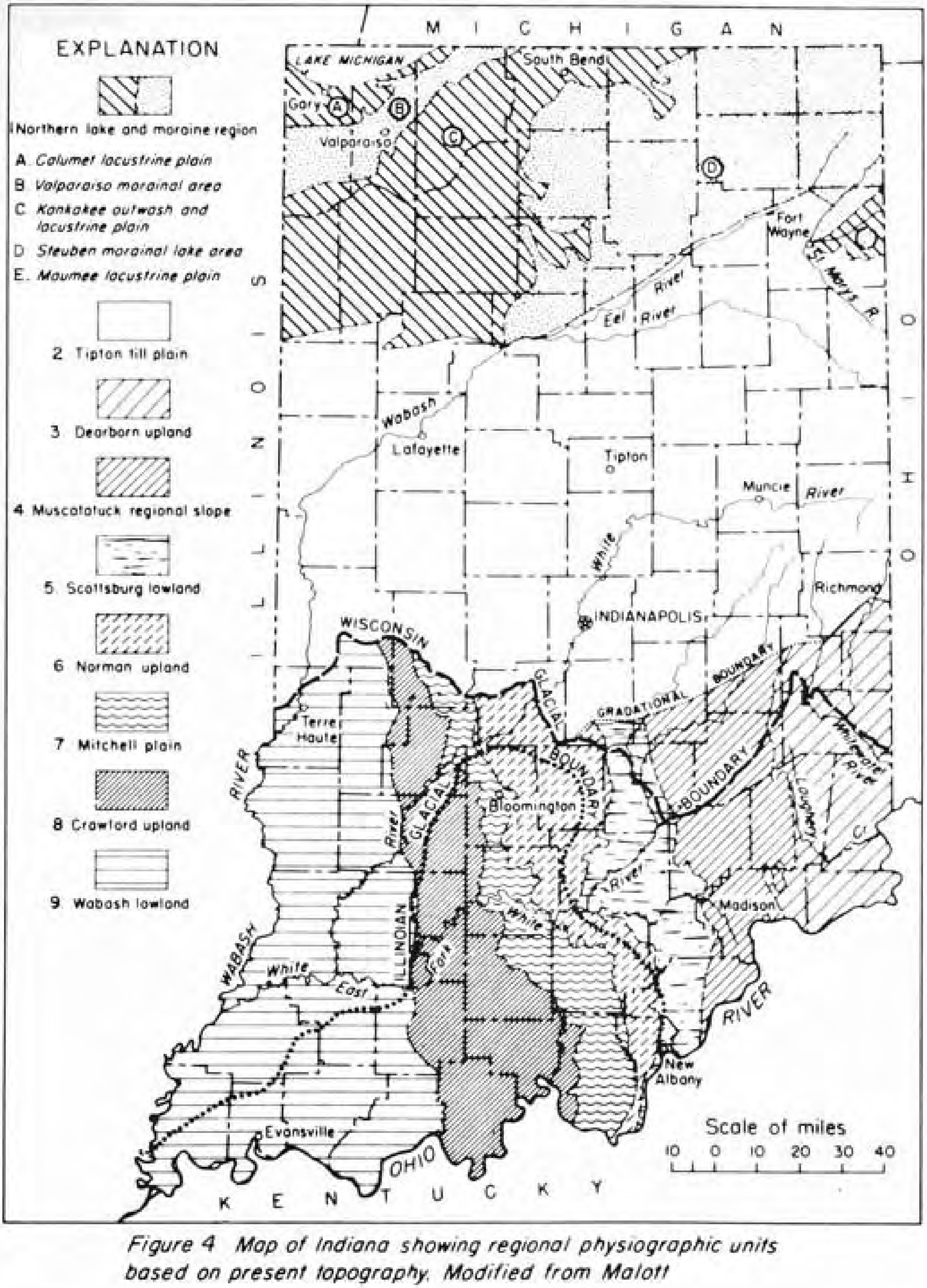


Figure 4. Map of Indiana showing regional physiographic units based on present topography. Modified from Malott

Topography

Physiographically Vermillion County is a plain of low relief. Topographically it consists of a gently rolling to undulating morainic belt near the central portion of the county and a very gently undulating to nearly level till plain in the northern and southern sections of the county. This relatively flat upland surface is severly dissected by the deeply entrenched major streams and rivers (Figure 5). Two huge river terraces are located along the Wabash River.

The elevation of the upland or the glacial drift plain ranges from 600 to 670 feet above sea level. The elevation of the terrace in general varies from 500 to 550 feet above sea level. However, a few knolls on the terraces reach an elevation of 580 feet near the valley wall about two and one-half miles southwest of Perrysville. Maximum local relief of Vermillion County is about 200 feet located on the bluff of the Wabash River in Sec. 22, T.16N., R.9W. about two and one-half miles north of Hillsdale. Local relief, of a magnitude of 100 feet, is common along the bluffs of the major rivers and streams within the county. Strip waste piles, with intervening lakes and ponds, add unique landscape features to the relatively level plain in the southern part of the county.

Geology

The entire area of Vermillion County is covered by the Trafalgar formation of the Wisconsinan drift of the Pleistocene Epoch (12). The region within the Wabash River Valley and the major streams are the outwash facies of the Atherton formation

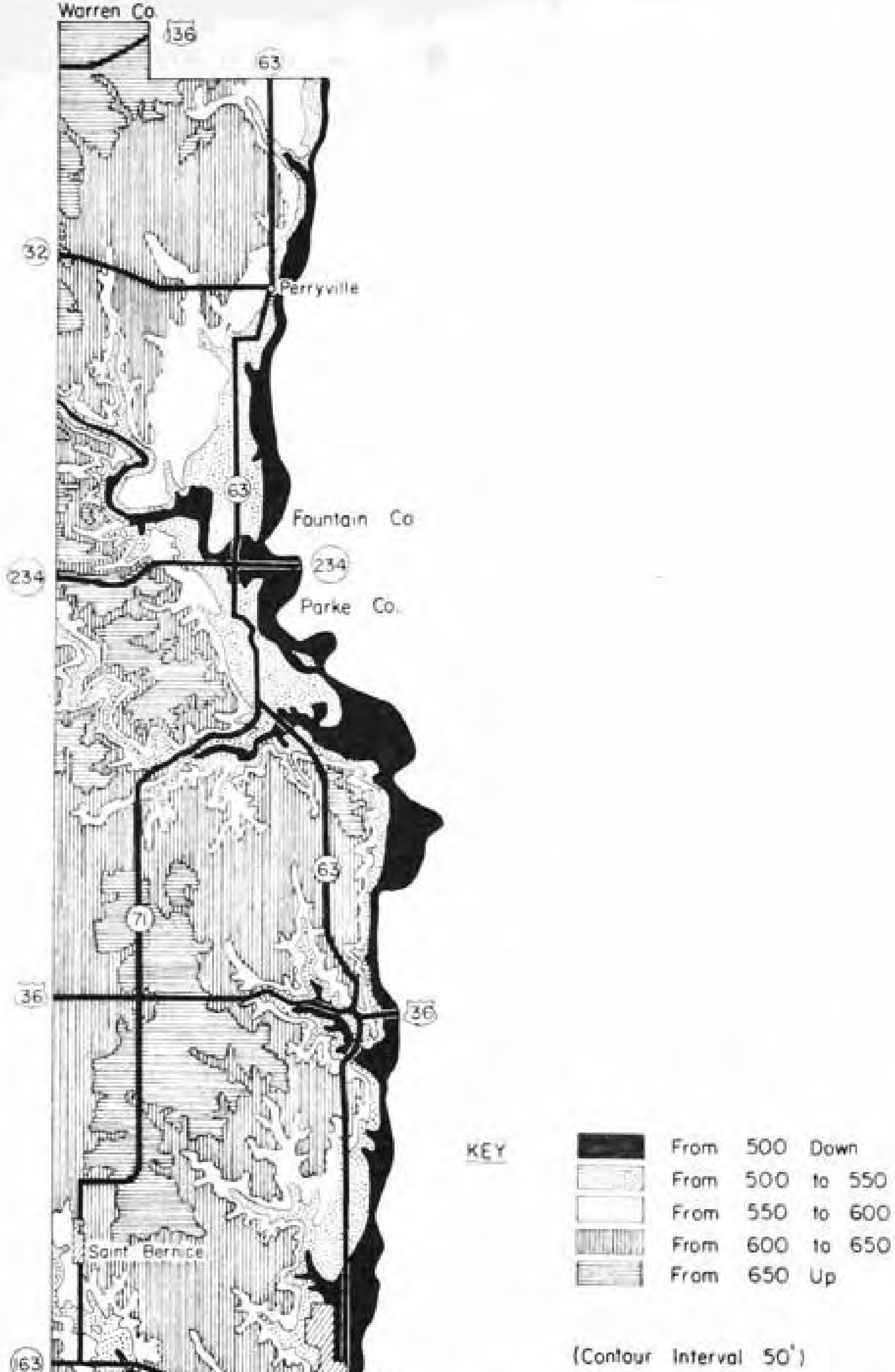


FIG. 5 TOPOGRAPHIC MAP OF VERMILION COUNTY

or the Martinsville formation of fluvial deposits (12). A thin blanket of eolian material covers the entire upland surface.

The thickness of the glacial drift varies from nothing to over 150 feet. The thickness of drift in the southern half is usually less than 50 feet above the bedrock surface (Figure 6). Slightly thicker drift deposits are in the northern half of the county. Drift of more than 150 feet is found in the buried preglacial valleys. Bedrocks are exposed along the valley walls of the principal streams such as: Spring Creek, Jordon Creek, Vermillion River, Little Vermillion River and Brouilletts Creek. Some of the exposures are listed in, "The Clays and Clay Industries of Indiana" (13).

The Wisconsinan drift region consists of ground moraine and ridge moraine. The moraines in the southern part of Vermillion County belong to the Shelbyville morainic system of the early Wisconsinan drift (Figure 7). The Northern portion of the county lies in the Champaign morainic system.

In the Wabash River Valley, and its major tributaries, thick valley train deposits in the form of terraces and flood plains are present.

The entire county is blanketed by various depths of windblown deposits. It varies from 18 to 40 inches in the western part of the county to several feet near the valley wall of the Wabash River. The bedrock strata beneath the glacial material, in Vermillion County, belongs to the Pennsylvanian system. The Conemaugh Series occupies only the southeastern corner of the county, while the Allegheny Series underlies the major portion of the county. The oldest formation, the Raccoon Creek Group, lies on the northeastern portion of the

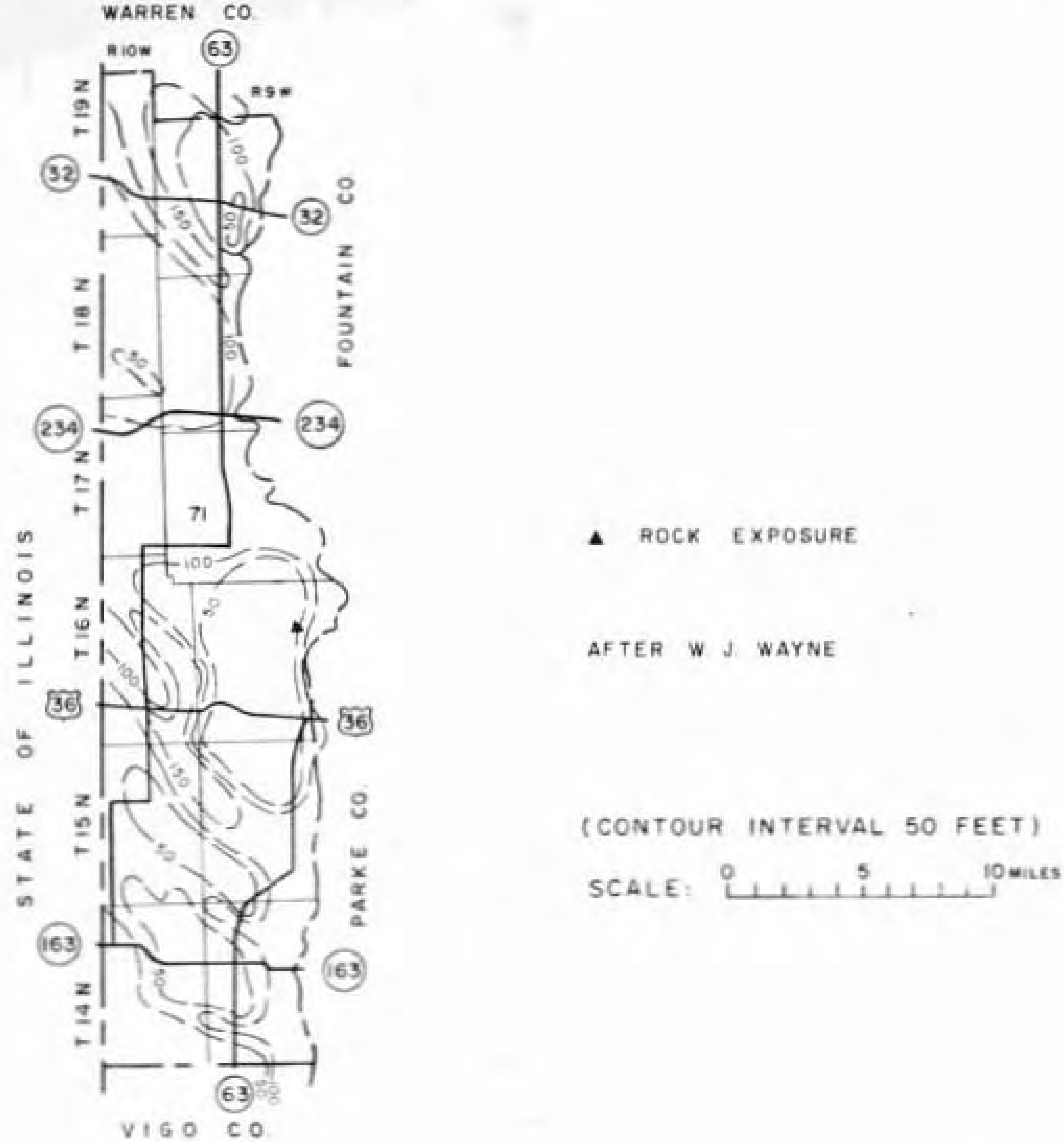


FIG. 6 THICKNESS OF GLACIAL DRIFT IN VERMILLION COUNTY, INDIANA

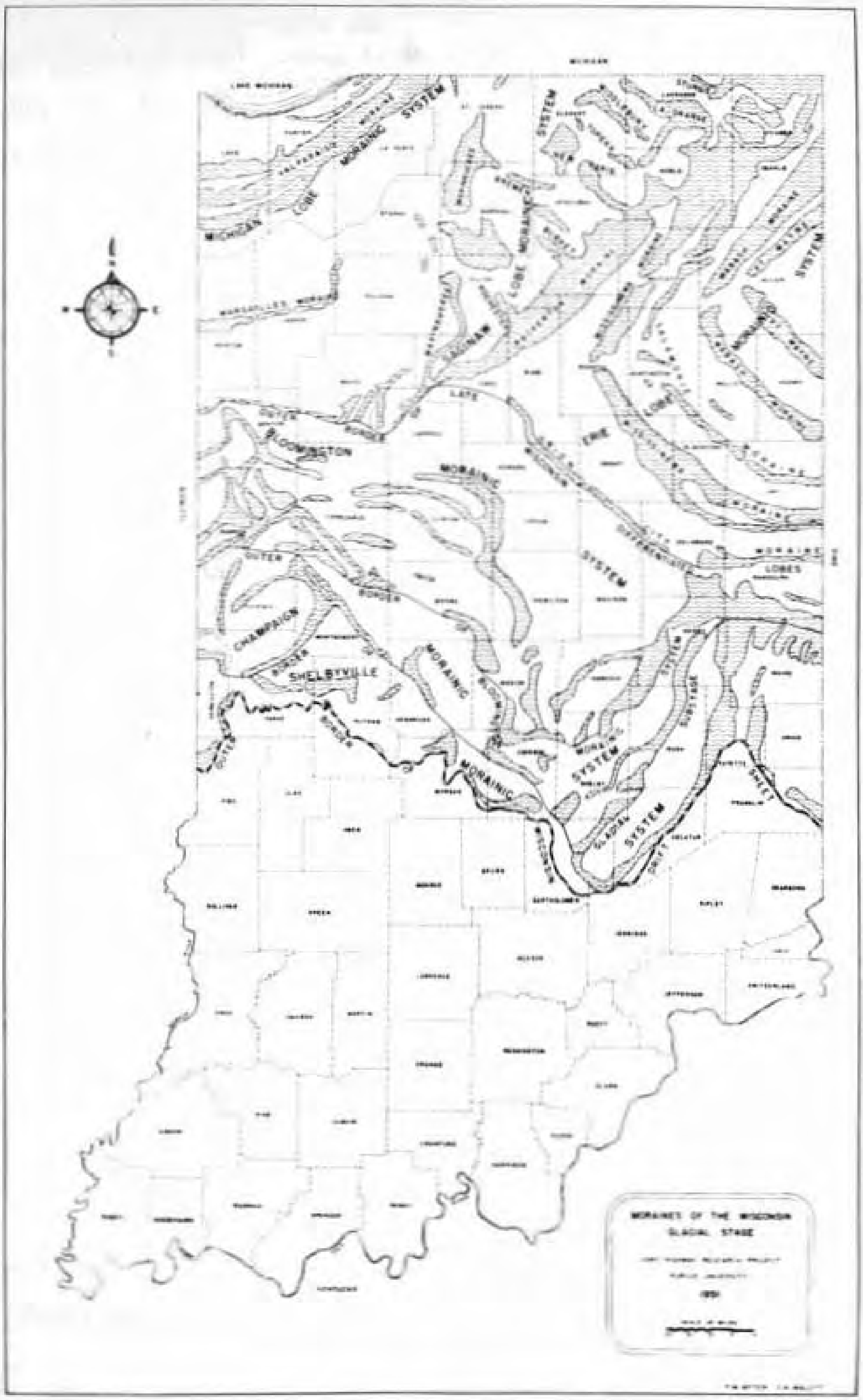

MICHIGAN
LOBE
MORAINIC
SYSTEM
BLOOMINGTON
MORAINIC
SYSTEM
CHAMPAIGN
SHELBYVILLE
ERIE
LOBES
GLACIAL
SYSTEM
MORAINES OF THE WISCONSIN
GLACIAL STAGE
1951

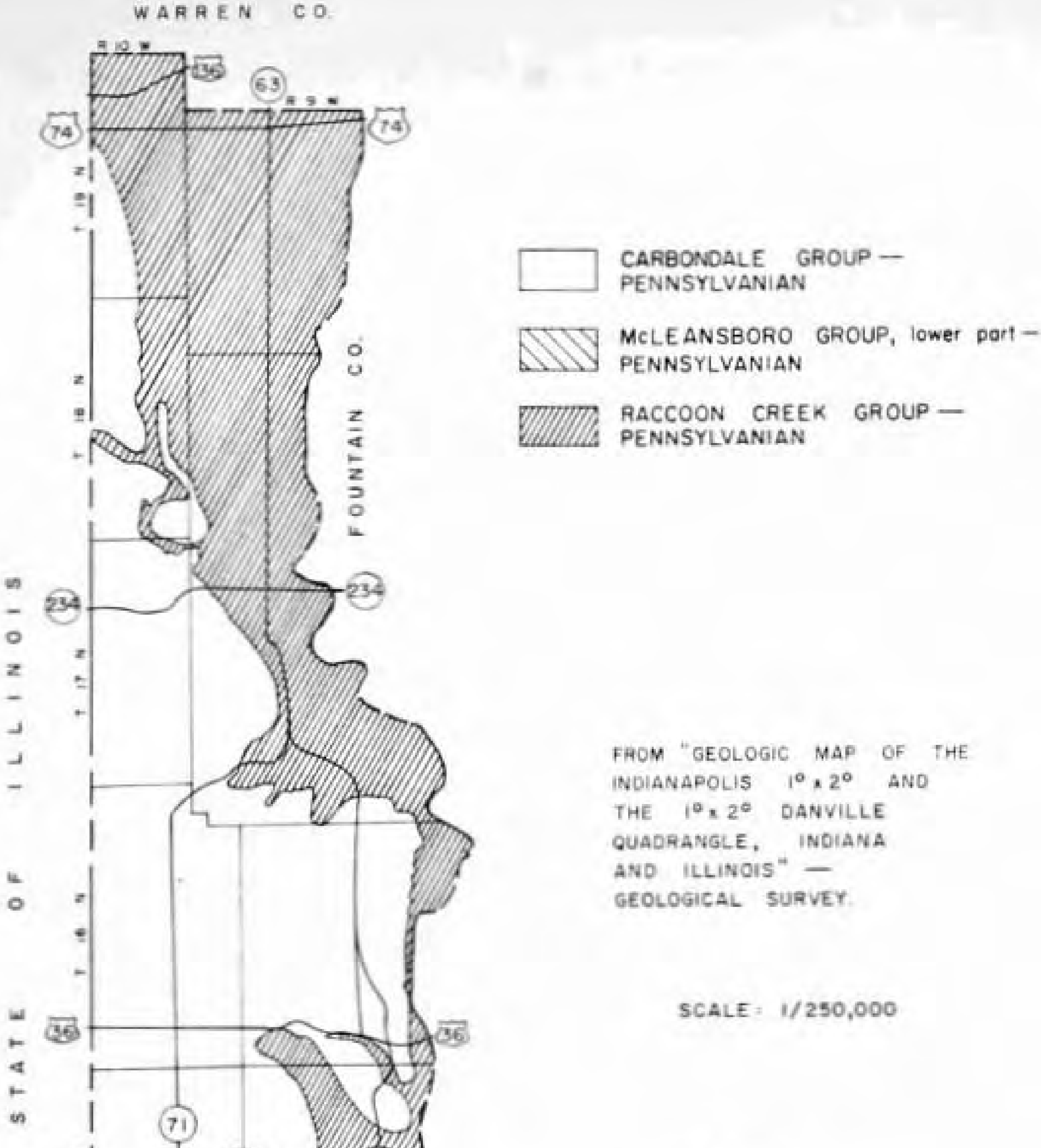
FIG. 7

county. The Carbondale Group occupies the central and southern portion, and the youngest McLeansboro Group is situated at the southwestern corner of the county (Figure 8).

Numerous rock exposures occur along the bluffs of the major rivers and streams within the county and, of course, rock is exposed in the strip mine area. The coal measures of the Carboniferous system form the rock surface of the entire county. However, Mansfield Sandstone of the same age is exposed along a very narrow strip on the western bank of the Wabash River in the northern fourth of the county, from Jordon Creek north to the county boundary (13).

A geologic section in a ravine in the SW 1/4 of Section 26 T.16N. R9W., shows the following profile (12):

Soil and drift	5 to 7 ft
Sandstone	2 to 10 ft
Light gray sandy shale	1 to 6 ft
Coal VII	3 to 5 ft
Underclay	3 to 4 ft
Drab to blue clayey shale	25 to 30 ft
Concretionary iron carbonate (two bands)	6 ft
Black fissile shale	2 to 3 ft
Coal VIb	1 ft
Underclay (white siliceous)	5 to 7 ft
Blue and drab clayey shale	42 ft
Black sheety shale	2 ft
Coal VIa	1 ft 8 inches
Underclay	8 ft



FROM "GEOLOGIC MAP OF THE INDIANAPOLIS 1° x 2° AND THE 1° x 2° DANVILLE QUADRANGLE, INDIANA AND ILLINOIS" — GEOLOGICAL SURVEY.

SCALE: 1/250,000

FIG. 8

GEOLOGIC MAP OF VERMILLION COUNTY

The general section in the southern part of the county, near Clinton, is as follows (12):

Soil and clay	9 ft
Shale or underclay	4 ft 6 inches
Blackshale or bone coal	2 ft
Coal VIII	4 ft 4 inches
Blue gray underclay	5 ft
Limestone, gray flinty, fossiliferous	2 ft 8 inches
Gray to blue sandy or clayey shale	53 ft.
Limestone, hard, flinty	1 ft
Dark blue shale	5 ft 8 inches
Bone coal and black sheety shale	4 ft
Coal VII	5 ft
Underclay	3 ft
Drab to blue sandy to clayey shale	60 ft
Black sheety bituminous shale	3 ft 10 inches
Coal VIb	1 ft 8 inches
Underclay	5 ft

LAND FORM AND ENGINEERING SOIL AREAS

The engineering soils in Vermillion County are derived mainly from unconsolidated materials. The unconsolidated materials include glacial deposits, glacial-fluvial depsoits, alluvial deposits, eolian deposits and cumulose deposites. A very limited area may be considered as a residual soil or non-soil area. However, due to the scale limitation of the attached map many narrow strips of rock outcrops along the valley wall of the major rivers and streams of the county cannot be shown. In the strip mining areas the waste piles, as indicated on the map, should be considered as non-soil areas.

The deposits of transported materials are not homogeneous and variation should be expected. General properties and profiles of the soils, for each area of different land form, are presented in this report.

Glacial Deposited Materials

Essentially all the soils of Vermillion County are of glacial origin. The major portion of the county is covered by glacial deposits of Wisconsinan age called the Trafalgar formation. The glacial deposits are derived from two different glacial lobes. The southern portion is covered by the deposits of the Shelbyville morainic system, the oldest morainic formation of the Wisconsinan Age. The rest of the glacial deposits are derived from the Champaign morainic system (Figure 7). Both morainic lobes deposited till-like material with only limited amounts of sands and gravels. The ridge moraines, and associated ground moraines are not very distinctly marked. All glacial deposits, however, are covered by a thin blanket of windblown silt with a depth varying from 18 inches to three or four feet near the Wabash River. Since the loess deposits is not deep it is not considered separately in this report.

1. Loess Covered Ridge Moraine

Several morainic ridges are recognized in Vermillion County. The most prominent one is located between the Vermillion River and the Li tle Vermillion River. A gently rolling to undulating topography which ranges from 20 to 40 feet above the adjacent ground moraine can be expected along this ridge. Two less prominent ridges of the Champaign moraine are located north and south of Cayuga along the bluff of the Wabash River. The boundary of these morainic ridges is difficult to delineate in places because of the weak undulating topographic expression. A small ridge area, which is the extension of the Champaign morainic system, is located about two miles north of Quaker. This ridge moraine is the tip end of a prominent ridge moraine in Illinois. It is only slightly higher than the adjacent ground moraine.

Near the southern border of the county, in the vicinity of Universal, there is a ridge moraine that extends into Vigo County. This ridge moraine belongs to the Shelbyville morainic system, the oldest moraine of Wisconsinan Age. The topography of this ridge moraine is weak in Indiana. It merges with the ground morainic plain so gradually that the border is difficult to determine.

The texture of the ridge moraine varies from one place to the other. It is subdivided into two groups, namely sandy-textured ridge moraine and medium-textured ridge moraine.

(A) Loess Covered Sandy-Texutred Ridge Moraine

Only small portions of the ridge moraine can be classified as sandy textured in Vermillion County. They occur north of Cayuga. The most prominent one is located west of Perrysville. A rolling topography, typical of a sandy deposit, is shown in the stereoscopic view from the aerial photography. Surface drainage is poorly developed or absent while infiltration basins may be numerous in places. A small deposit that lies about two miles northwest of Eugene also has the hummocky expression. However, the largest deposit is along Spring Creek and is very weak in topographic expression. The surface is undulating with little or no topographic break from the adjacent ground moraine to the west.

The soil of this deposit is developed under the influence of a thin mantle of loess (18-40 inches). The texture of the surface soil varies from a sandy loam to loam in the high position to silty-clay loam or clay loam in the level land or depressions. The subsoil ranges from sandy-clay loam to clay. The parent material is generally sandy loam but sand or clay loam may be found in places.

Soil profiles from the boring data long SR 6[3], from sites No. 36 and No. 37 and No. 49 to No. 54 in the north, verified the general profile. For instance, the surface soil taken from 0.5 to 2.0 feet on site No. 50 is classified as sandy loam (A-6) soil. It contains 52% sand 29%silt and 19%clay. The sample taken from 6.0-8.0 feet is recognized as sandy loam (A-2-4) soil with 74% sand 20% silt and 6% clay. The profile at site No. 37, located near the edge of the moraine, shows a silty clay loam (A-6) surface soil and sand (A-2-4) subsoil at a depth of 5.0 to 6.0 feet from the surface. The soil becomes more sandy and gravelly (A-1-6) at a depth of 12 feet from the surface.

(B) Loess Covered Medium-Textured Ridge Moraine

The major portion of the ridge moraine within the county belongs to this category. The most prominent one lies between the Vermillion River and the Little Vermillion River. The rest is weak in topographical expression, especially the one near Hillsdale and the one on the southern border.

The soil of this deposit is developed under the influence of a thin mantle of loess (18-40 inches). The texture of the A horizon ranges from silt loam to silty clay loam (A-4 to A-6) in the high positions to a silty clay or clay (A-7-6 to A-6) in the low positions. The B-horizon varies from a silty clay loam to clay (A-7). The parent material has a texture of either a silt loam, silty clay loam or clay loam (A-6).

Soil profiles from the boring data along 63, from sites No. 10 to 12 and No. 38 and No. 39, varified the generalized profiles. The reader should keep in mind that lenses of sandy or gravelly materials may be encountered in the ridge moraine deposits especially at the vicinity of major drainage channels. At sites No. 39 and No. 10, the sample taken between 0.5 to 2.0 feet is a silty clay (A-7-6). The parent material taken between 4.0 to 6.0 feet is a silt loam (A-6). A sandy loam soil (A-4) is found 6.0 to 8.0 feet below the surface at site No. 10.

2. Loess Covered Medium-Textured Ground Moraine

The major portion of Vermillion County is covered by ground moraine deposits. The topography of the ground moraine varies from undulating to nearly level except along the vicinity of drainage channels where dissection occurs producing a rough topography.

The ground moraine in this country is medium in texture. However, due to the different types of vegegation cover, the deposit is subdivided into timber and prairie soils.

(A) Loess Covered, Medium-Textured Ground Moraine - Timber Region

The main portion of the ground moraine deposits in Vermillion County belong to this category. The surface of this region is very gently undulating except the areas close to the drainage channels where the gullies and streams are deeply entrenched because of the great difference of base level (about 100 feet in most cases). The surface drainage is poorly developed in the nearly flat land or in the headwater areas. The thickness of the loess cover varies from place to place. It is thicker near the Wabash River and may be reduced to nothing along the valley walls by water erosion.

The soil profile developed in this region may be entirely from the loess deposit as the loess deposit is deep. Silty clay (A-7-6 to A-6) soil is common in the upper horizon. Silty loam (A-4) or clay loam (A-4) soils are found in the parent material.

Boring sites No. 1 to No. 4 are located in this region. They show about six inches of topsoil over about three feet of silty clay (A-7-6). The underlying parent materials are silty-clay loam (A-4) soil. Boring site No. 4, located next to a deep gully and near the edge of the ridge moraine, has a somewhat coarser texture. The surface soil is loamy (A-6) in texture to a depth of five feet followed by a sandy loam (A-4) soil.

(B) Loess Covered Medium-Textured Ground Moraine - Prairie Region

Deposits at the northwestern corner and part of the southwestern portion of the county are recognized as loess covered medium-textured ground moraine developed under prairie vegetation. Very gently undulating to near level topography prevails in these areas.

Surface drainage is poorly developed or absent. Many shallow depressions are scattered in the area situated at the north western corner of the county. The basins are usually ponded after heavy rainfall. Many ditches are developed to facilitate the surface drainage in this region. The darker and more uniform photo tonality of this deposit makes the delineation of the boundary fairly easy.

The loess cover in this area varies from 18 to 36 inches. The soil profile is characterized by an organic loam to silty clay loam top soil in the high position to an organic clay in the low position; a silty clay to clay (A-7-6) subsoil, and generally a clay loam (A-6) parent material.

Boring sites No. 42 to No. 48, are located within this region. The B-horizon taken from 0.5 to 2.0 feet below the surface, at sites No. 44, 46 and 47, has a texture ranging from silt clay loam to silty clay or clay. They are all classified as A-7-6 soils by the AASHO classification. The parent material taken between a depth of 5.0 to 6.0 feet, in site No. 48, is a clay loam (A-6). At site No. 43, taken between 4.0 to 6.0 feet, the parent material is a silty clay loam (A-6) soil.

3. Moraine on Bedrock

Several areas in Vermillion County where bedrock is exposed near the ground surface are mapped as moraine on bedrock. These soils occur chiefly along the valley wall of the Wabash River. A large number of this category are too narrow in width to be mapped on the attached soils map. The reader should be aware of the presence of these rock areas south of Newport along the toe of the steep valley wall in the southern part of the county. The larger areas that can be presented on the map are located on the southern edge of the city of Newport and south of Clinton. There is an isolated area along Vermillion River near the Illinois State line also mapped as moraine on bedrock.

In most places the soil consists of a mixture of glacial drift and shale. The soil profile is shallow - particularly on the steeper slopes where the material is more or less colluvial. Weathering has taken place in the bench-like topographic position. The unaltered shaly bedrock lies at various depths - in many places occurring within a few inches of the surface.

The soil profile ranges from a fine sandy loam or a silt loam to a loam top soil in the high positions, and to silty clay or clay in the low areas. The B-horizon varies from a clay loam to clay with an increasing amount of shale fragments toward the bedrock stratum. The bedrock is mostly shale with interbedded sandstone, coal and underclay.

FLUVIAL DEPOSITED MATERIALS

About one quarter of Vermillion County is covered by fluvial deposited materials. Two different land forms, created by the action of water, namely terraces and flood plains occur and are discussed below.

1. Terraces

About one half of the fluvial deposits in the county are terrace deposits. The main body of the terrace deposits lies within the valley wall of the Wabash River north of Newport. The next largest is situated in the vicinity of Clinton. Smaller terraces are scattered along Spring Creek, Little Vermillion River, Little Raccoon Creek and Brouilletts Creek. The largest terrace deposit, near Newport, has two levels. Small isolated terraces along the major rivers and streams have a bench-like topography and are classified as thin terrace on bedrock. The terrace deposits are subdivided into gravelly-textured terraces and sandy-textured terraces.

A. Gravelly-Textured Terraces

The gravelly-textured, or coarse-textured terraces, are mainly associated with the Wabash River Valley. The surface of this deposit is characterized by numerous infiltration basins and current markings. This deposit has a dark photo tonality because of the original prairie grass cover. Since the soil is essentially the same as the light-colored, coarse-textured, terrace deposit(except the first six inches which contains considerable organic matter), no separation is made for them.

The surface soil varies greatly from place to place. It ranges from a sandy loam to a silty clay loam. The organic content is high in the first six inches of soil in the prairie area. Along swells and ridges gravelly-sandy surface soils may be encountered. The B-horizon shows generally an increase of clay and plasticity with respect to the layer above. It varies from a sandy clay loam to clay (A-7-5 to A-7-6 soil). An increase in the amount of sand and gravel is found with the increase of depth. Stratified sand and gravel is found in the calcareous parent material.

Boring sites, No. 17 to No. 35, are located within the gravelly-textured terrace deposit. The data verified the variation of this deposit. Many gravel pits have been developed on this terrace deposit. The larger ones are located near Cayuga.

B. Sandy-Textured Terrace

The sandy- or medium-textured terrace deposits occur along the edge of the valley wall of the Wabash River in the slack water areas. Occasionally it lies on the outside edge of the gravelly-textured terrace deposits. The terrace near the southern border of the county is considered as a sandy-textured deposit. All the bench-like deposits along the major drainage channel of Vermillion County are recognized as sandy-textured terrace deposits.

Infiltration basins are less prominent in the sandy-textured deposits than the gravelly-textured deposits along the Wabash River. However, current markings are more prominent and have developed into surface drainage channels. Both infiltration basins and current markings are absent in the bench-like isolated terraces along the major streams of the county. Bedrock may be found near the stream level.

The surface soil ranges from a silt loam to a silty clay loam on the high position to silty clay or clay in the low area. The B-horizon is a plastic silt clay or clay soil. The stratified sand and gravel generally is found between a depth of 30 inches to 54 inches.

Boring site No. 9 is located on this deposit. The sample taken between 2 to 4 feet is a clay A-7-6 soil. Sand (A-2-4) soil is found between 6 and 22 feet. The soil profile of this site indicates the top soil (0-2.0 feet) is a sandy loam (A-2-4) soil. This material is likely to be a reworked deposit by the water from the adjacent land as the site is located on the slope near a gully.

C. Thin Terrace on Rock Benches

A small area along the bank of Spring Creek is recognized as a thin-terrace on a rock bench. Sandstone rock is exposed almost at the surface of the terrace. No infiltration and current markings are recognized on this thin-terrace deposit.

The surface soil texture and development varies greatly in this deposit. The soil profile is characterized by a sandy loam to a clayey top soil underlain by a sandy loam to clayey subsoil. Rock fragments occur before the solid rock is reached. The bedrock is interbedded sandstone and shale.

2. Flood Plain

Vermillion County has a relatively large amount of flood plains along the rivers and streams. The large extent of these plains is obvious on the attached engineering soils map.

The largest flood plain is associated with the Wabash River. Little Vermillion River and Brouilletts Creek also possess wide flood plains. Most of the flood plains have flat to nearly level surfaces. Natural levees and current scars are numerous along the major river channels.

The texture of the flood plain deposits varies greatly both horizontally and vertically from place to place. Coarse-textured deposits, at depth, are generally located along the Wabash River. Fine sandy loam surface soil is the most common texture of the flood plains in the county. Finer surface soils such as silt loam, silty clay loam and clay loam are found along the Wabash River and Brouilletts Creek. Stratified sands and gravels sometime mixed with seams of silt and clay are found in the substratum. Sandstone and shale bedrock may be encountered at a shallow depth.

In the swales and depressions of the slack water areas, where water may pond, a highly organic silt loam to clayey topsoil may be found. The underlying material is usually stratified silty sand and clay.

EOLIAN DEPOSITED MATERIAL

There are extensive eolian (wind) deposits in Vermillion County. The eolian deposits are subdivided into two groups - loess deposits and sand dune deposits.

1. Loess Deposits

Nearly the entire area of Vermillion County is covered by a thin mantle of loess. As mentioned previously, the mantle generally varies in depth from 18 to 40 inches. Since the mantle is relatively uniform and comparatively thin, only the top part of the soil profile is subject to loess influence. Therefore the discussion of this loess mantle is not treated separately but included with the glacial land forms previously discussed.

2. Sand Dunes

The sand dune deposits in Vermillion County are very limited. Windblown sand veneers may be found on the eastern side of the valley wall of the large sandy flood plain and on the huge Wabash River terrace. The recognized sand dunes are confined along the Vermillion River near the Illinois State line. Four separate ridges are mapped in that vicinity. The sand dunes are very narrow and of low relief.

The soil profile consists of a very friable find sand or sandy loam top soil underlain by a slightly cohesive clayey sand or sandy clay loam. A layer of sand or loamy fine sand may be encountered before the fine sand stratum is reached. The underlying material of the largest dune is glacial drift materials and the rest is sand and gravel terrace material.

RESIDUAL SOIL

Residual soils, developed inplace from interbedded sandstone and shale, are found only to a very limited extent in Vermillion County. As mentioned previously, the bedrock outcrops occur along the major valleys in the county and very little residual soils are formed in these areas because of steep slopes and severe erosion. Also, glacial materials, washed onto the rock surfaces (colluvial soils), prevent the development of residual soils. Therefore, no residual soil areas appear on the attached soils map.

CUMULOSE MATERIALS

Accumulation of cumulose, or organic materials, occur frequently on the various land forms previously described. The most frequently occurring cumulose deposits occupy depressions in the ground morainic area at the northern part of the county. Two separated areas in the flood plain of the Wabash River also belong to this category. These areas are designated as the highly organic topsoil depressions on the soils map.

In the depressed areas where internal drainage is somewhat retarded, the accumulation of organic matter usually occurs. The find-grained soil and the organic matter form a highly organic silty clay or clay topsoil. The subsurface soil is a plastic silty clay or clay. The character of the subsoil depends on the surrounding land form. A loam or clay loam or clay soil may be found in the depression on the ground morainic region. Stratified sand, silt and gravel may be encountered in the depressions located on the flood plain.

MISCELLANEOUS

Strip Mines

In the southern quarter of Vermillion County there are a number of coal strip mines. The largest one is located in the vicinity of Centenary. The more recent large strip mine lies south of Universal. Both the pit and the spoil material area are included in the strip mine area on the attached engineering soils map.

The spoil was most frequently dumped in elongated piles and consist of a heterogeneous mixture of soil materials, sandstone boulders and slabs, shale slabs and some coal. Some of the older spoil has been reforested. Some pits contain water as indicated on the map.

The boundaries of the strip mine are based on the 1939 airphoto and 1971 NASA aerial photography. Some of the stripping has been subsequently widened and a new site may have been opened. Field investigations of this area are required.

Underground Mines

A number of underground mines or shaft mine operations were sighted on the 1939 airphotos in the southern quarter of the county. They are indicated also on the attached engineering soils map. Due to the collapse of the underground chamber a number of basins developed on the surface. Engineers should investigate the location of the underground mining area before the design of important structures.

Shale Pits

A number of shale pits or clay pits are recognized in Vermillion County. They are confined to the central portion of the county. The biggest one is located along the bluff of the Wabash River north of Highland. Smaller ones are located near Newport and Cayuga. Clay factories usually can be identified from the airphoto near the smaller pits. Some of the profile descriptions may be found in the report on the "Clay and Clay Industries of Indiana" (13).

Gravel Pits

Many gravel pits are found on the terraces of Vermillion County. The larger ones are found located near the cities where the demand for sand and gravel is great. The gravel pits are confined mostly to the Wabash River terraces. Some of the abandoned pits became ponds and are shown on the soils map. The extend and location of the pits are indicated on the engineering soils map.

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APPENDIX A

Soil boring data along S.R. 63

The soil test data tabulated below was obtained from consultants' reports prepared for the Indiana State Highway Commission. The location of the site is shown on the attached engineering soils map. Considerable additional data is contained in the consultants' reports.

Site	Station	Offset (ft.)	Depth (ft.)	AASHO Classification	Texture	Percent				L.L.	P.I.
						Pass.#10	Sand	Silt	Clay		
1	384+08		1.0-2.0	A-7-6(17)	Si.Cl.	100	1	59	40	51	28
			5.0-6.0	A-2-4(0)	Sa.Cl.L.	99	69	10	21	23	10
2	394+00		3.0-4.0	A-4(5)	Cl.L.	87	40	38	22	24	10
3	406+00		5.0-6.0	A-4(8)	Si.Cl.L.	99	1	77	22	30	10
4	435+50	84 L	0.5-2.0	A-6(7)	Loam	96	44	38	18	33	16
			15.0-16.0	A-4(0)	Sa.L	87	64	17	19	22	10
5	460+50		0.5-2.0	A-4(7)	Si.L.	97	31	53	16	30	6
6	464+00	84 L	3.0-4.0	A-1-b(0)	Sa.Gr.	62	85	12	3	NP	NP
7	470+00	84 L	7.0-8.0	A-2-6(0)	Gr.Sa.	68	83	9	8	27	12
8	497+75	84 L	3.0-5.0	A-2-4(0)	Sa.L.	100	65	17	18	19	7
			5.0-6.0	A-6(10)	Si.Cl.	100	12	56	32	36	15
9	520+00	84 L	2.0-4.0	A-7-6(15)	Clay	100	25	39	36	44	26
			18.0-20.0	A-2-4(0)	Sand	95	83	11	6	NP	NP

Site	Station	Offset (ft.)	Depth (ft.)	AASHO Classification	Texture	Percent Pass.#10	Percent Sand	Percent Silt	Percent Clay	L.L.	P.I.
10	558+00	42 L	0.2-2.0	A-7-6(18)	Si.Cl.	99	1	55	44	52	30
			4.0-6.0	A-6(11)	Si.Cl.	99	4	66	30	37	17
			6.0-8.0	A-4(1)	Sa.L.	96	60	26	14	19	6
11	568+00	42 L	4.0-6.0	A-6(8)	Clay	94	38	32	30	29	16
12	579+25	60 L	0.0-2.0	A-2-4(0)	Sa.L.	82	69	21	10	18	6
13	2+00	42 Rt	2.0-4.0	A-1-a(0)	Sa.Gr.	39	94	3	3	NP	NP
			19.0-20.0	A06(10)	Clay	94	23	44	33	40	16
			22.0-23.0	A-6(7)	Cl.L.	94	43	30	27	38	16
14	16+00	42 Rt	1.0-2.5	A-7-6(15)	Si.Cl.	100	5	64	31	47	23
15	28+00	42 Rt	28.5-30.0	A-1-a(0)	Sa.Gr.	46	96	4	0	NP	NP
16	32+10	52 Rt	3.5-5.0	A-4(1)	Sa.L.	100	61	30	9	16	0
17	48+50	36 Rt	1.0-2.0	A-6(1)	Cl.L.	99	33	42	25	34	20
18	69+00	42 Rt	1.0-2.0	A-6(7)	Cl.L.	99	42	30	28	35	17
			3.0-4.0	A-2-6(0)	Sa.Gr.	44	81	4	15	40	17
			5.0-6.0	A-1-a(0)	Sa.Gr.	30	95	3	2	NP	NP
19	82+00	42 Rt	4.0-6.0	A-2-4(0)	Gr.Sa.	54	87	9	4	26	8
20	106+00	42 Rt	0.5-2.0	A-4(0)	Sa.L.	60	63	28	9	NP	NP
			8.0-10.0	A-1-b(0)	Sa.L.	47	78	14	8	NP	NP

Site	Station	Offset (ft.)	Depth (ft.)	AASHO Classification	Texture	Percent Pass.#10	Percent Sand	Percent Silt	Percent Clay	L.L.	P.I.
21	121+00	50 Rt	5.0-6.0	A-4(4)	Loam	99	45	44	11	NP	NP
			7.0-8.0	A-1-b(0)	Gr.Sa.	69	89	8	3	NP	NP
22	160+00	42 Rt	0.5-2.0	A-1-b(0)	Sa.L.	92	77	16	7	NP	NP
23	183+50	42 Rt	1.0-2.0	A-7-5(14)	Si.Cl.L.	96	10	68	22	51	19
24	195+00	42 Rt	5.0-6.0	A-1-a(0)	Sa.Gr.	38	93	6	1	NP	NP
25	210+00	42 Rt	5.0-6.0	A-2-4(0)	Sa.Gr.	37	93	5	2	24	7
26	228+00	42 Rt	0.5-2.0	A-6(3)	Sa.Cl.L.	81	56	20	24	38	13
27	239+50	42 Rt	0.5-1.5	A-6(6)	Cl.L.	96	46	26	28	38	16
28	259+00	42 Rt	1.0-2.0	A-7-6(9)	Cl.L.	79	44	28	28	48	22
29	270+00	42 Rt	6.0-7.0	A-2-4(0)	Sa.L.	61	72	20	8	NP	NP
30	285+00	42 Rt	8.0-10.0	A-2-4(0)	Sa.L.	91	69	28	3	NP	NP
31	305+00	42 Rt	5.0-6.0	A-6(4)	Cl.L.	88	48	32	20	23	11
32	310+00	42 Rt	1.0-2.0	A-7-6(10)	Si.Cl.	100	15	54	31	42	15
33	315+00	42 Rt	1.0-2.0	A-7-6(13)	Si.L.	99	11	73	16	47	19
			3.0-4.0	A-7-6(9)	Cl.L.	99	38	36	26	42	18
			5.0-6.0	A-4(1)	Sa.L.	57	61	30	9	NP	NP

Site	Station	Offset (ft.)	Depth (ft.)	AASHO Classification	Texture	Percent Pass.#10	Percent Sand	Percent Silt	Percent Clay	L.L.	P.I.
34	320+00	42 Rt	3.0-4.0	A-1-a(0)	Sa.Gr.	40	93	7	0	NP	NP
35	366+00	50 Rt	9.0-10.0	A-4(2)	Sa.L.	76	55	34	11	17	7
36	369+50	42 Rt	4.0-6.0	A-4(6)	Cl.L.	97	33	42	25	25	10
37	374+00	42 Rt	1.0-2.0	A-6(10)	Si.Cl.L.	100	9	62	29	37	15
			5.0-6.0	A-2-4(0)	Sand	100	85	9	6	NP	NP
			12.0-13.0	A-1-b(0)	Gr.Sa.	68	84	13	3	NP	NP
38	396+00	42 Rt	4.0-6.0	A-6(9)	Cl.L.	99	32	41	27	35	17
39	414+00	42 Rt	0.5-2.0	A-7-6(16)	Si.Cl.	100	15	50	35	45	27
			4.0-6.0	A-6(9)	Cl.L.	100	4	78	18	32	13
40	425+50	42 Rt	0.5-2.0	A-6(10)	Si.Cl.L.	100	2	72	26	33	14
41	447+14	42 Rt	1.0-2.0	A-7-6(19)	Clay	97	21	43	36	53	31
			3.0-4.0	A-7-6(18)	Clay	98	18	48	34	50	32
42	464+00	42 Rt	5.0-6.0	A-6(10)	Si.Cl.L.	95	9	71	20	33	14
43	481+50	42 Rt	2.0-4.0	A-7-6(15)	Si.Cl.L.	100	0	72	28	45	25
			4.0-6.0	A-6(9)	Si.Cl.L.	100	0	79	21	35	13
44	491+50	42 Rt	0.5-2.0	A-7-6(17)	Si.Cl.	100	8	58	34	54	25
45	501+00	42 Rt	1.0-2.0	A-7-6(16)	Si.Cl.	99	18	50	32	50	26

Site	Station	Offset (ft.)	Depth (ft.)	AASHO Classification	Texture	Percent Pass.#10	Percent Sand	Percent Silt	Percent Clay	L.L.	P.I.
46	528+50	42 Rt	0.5-2.0	A-7-6(20)	Clay	99	17	43	40	63	40
			2.0-4.0	A-6(9)	Si.L.	98	5	78	17	32	12
47	540+00	42 Rt	0.5-2.0	A-7-6(15)	Si.Cl.L.	99	16	57	27	43	26
48	553+00	42 Rt	3.0-4.0	A-7-6(12)	Si.Cl.L.	98	7	68	25	41	19
			5.0-6.0	A-6(7)	Cl.L.	92	38	39	23	27	14
49	558+00	42 Rt	5.0-6.0	A-2-6(0)	Gr.Sa.	62	81	2	17	27	12
50	582+50	42 Rt	0.5-2.0	A-6(3)	Sa.L.	90	52	29	19	32	12
			6.0-8.0	A-2-4(0)	Sa.L.	82	74	20	6	16	3
51	586+00	15 Rt	5.0-6.0	A-4(4)	Loam	90	46	37	17	22	10
52	597+00	42 Rt	9.0-10.0	A-2-4(0)	Sa.L.	91	77	9	14	27	10
53	605+00	42 Rt	4.0-6.0	A-6(6)	Loam	85	43	40	17	28	14
			22.0-24.0	A-4(0)	Sa.L.	77	63	26	11	18	9
54	632+50	42 Rt	5.0-6.0	A-6(4)	Sa.L.	67	55	27	18	30	16
			9.0-10.0	A-2-4(0)	Sa.L.	97	74	19	7	NP	NP

APPENDEX B

SOIL CLASSIFICATION AND PROFILE SYMBOLS

Description	Grain Size Distribution				Plastic Index	Symbol
	Gravel % Retained on #10	Sand #10–#200	Silt 0.05–0.005mm	Clay Less than 0.005mm		
Gravel	85-100	0-15	0-10	0-10	NP	
Sandy Gravel	50-85	15-50	0-10	0-10	6 Max.	
Sand	0-15	85-100	0-10	0-10	NP	
Gravelly Sand	20-49	45-85	0-10	0-10	6 Max.	
Sandy Loam	0-19	50-80	0-50	0-20	6 Max.	
Sandy Clay Loam	0-19	50-80	0-30	20-30	10 Max.	
Sandy Clay	0-19	55-70	0-15	30-45	11 Min.	
Loam	0-19	30-50	30-50	0-20	10 Max.	
Silt Loam	0-19	0-50	50-100	0-20	10 Max.	
Silty Clay Loam	0-19	0-30	70-100	20-30	11 Min.	
Silty Clay	0-19	0-15	55-70	30-45	11 Min.	
Clay Loam	0-19	20-50	50-80	20-30	11 Min.	
Clay	0-19	0-55	0-55	30-100	11 Min.	
Peat or Muck						
Limestone						
Sandstone						
Shale						
Stony Fragments						
Organic Matter						
Top soil						

Classification of Gravelly Soils

85%-100% gravel plus finer material - Gravel
50%-84% gravel plus finer material - Clayey, silty or sandy gravel
20%-49% gravel plus finer material - Use fine classification and called gravelly sand, gravelly silt or gravelly clay
0%-19% gravel plus finer material - Use fine classification only

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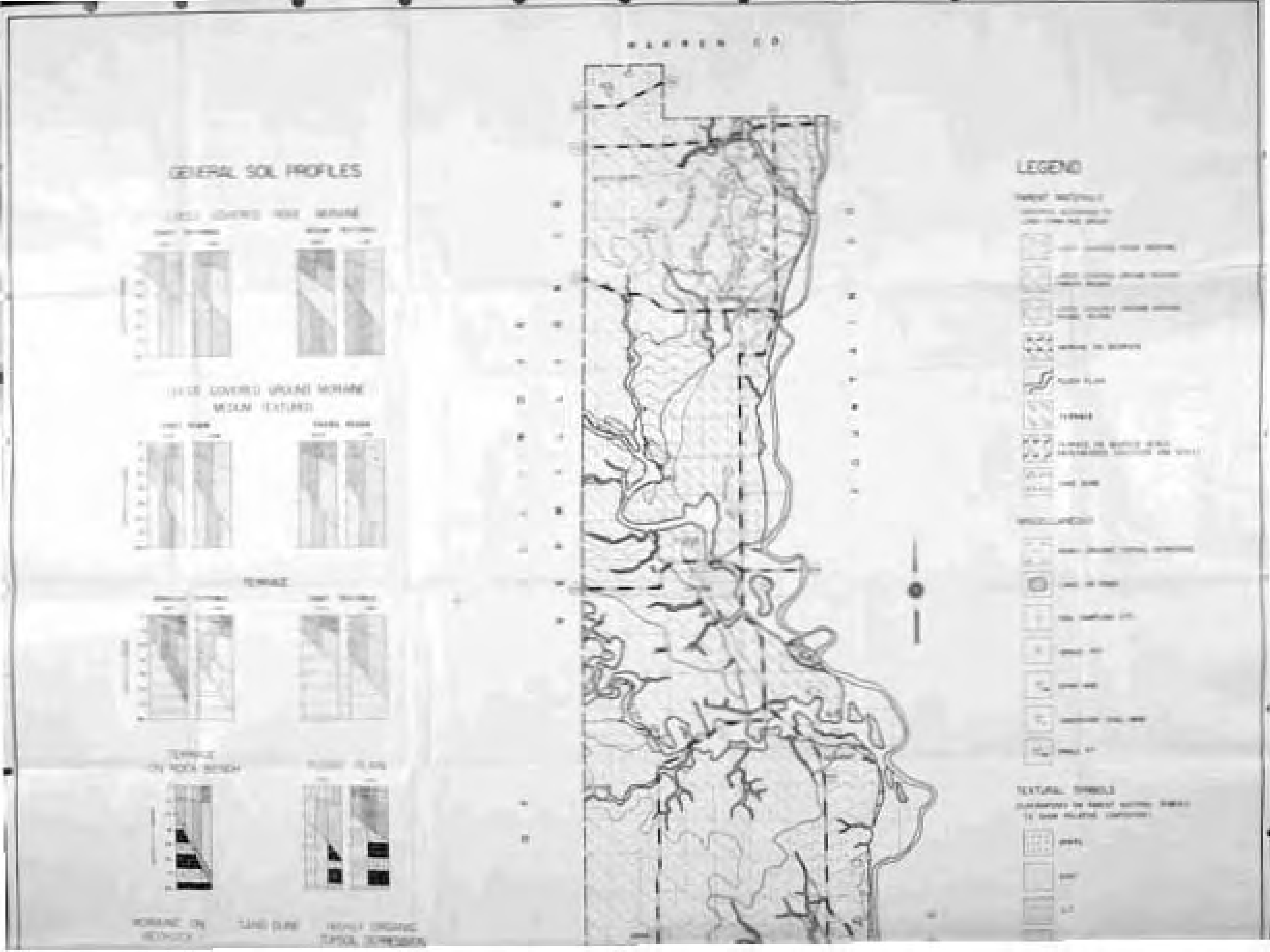
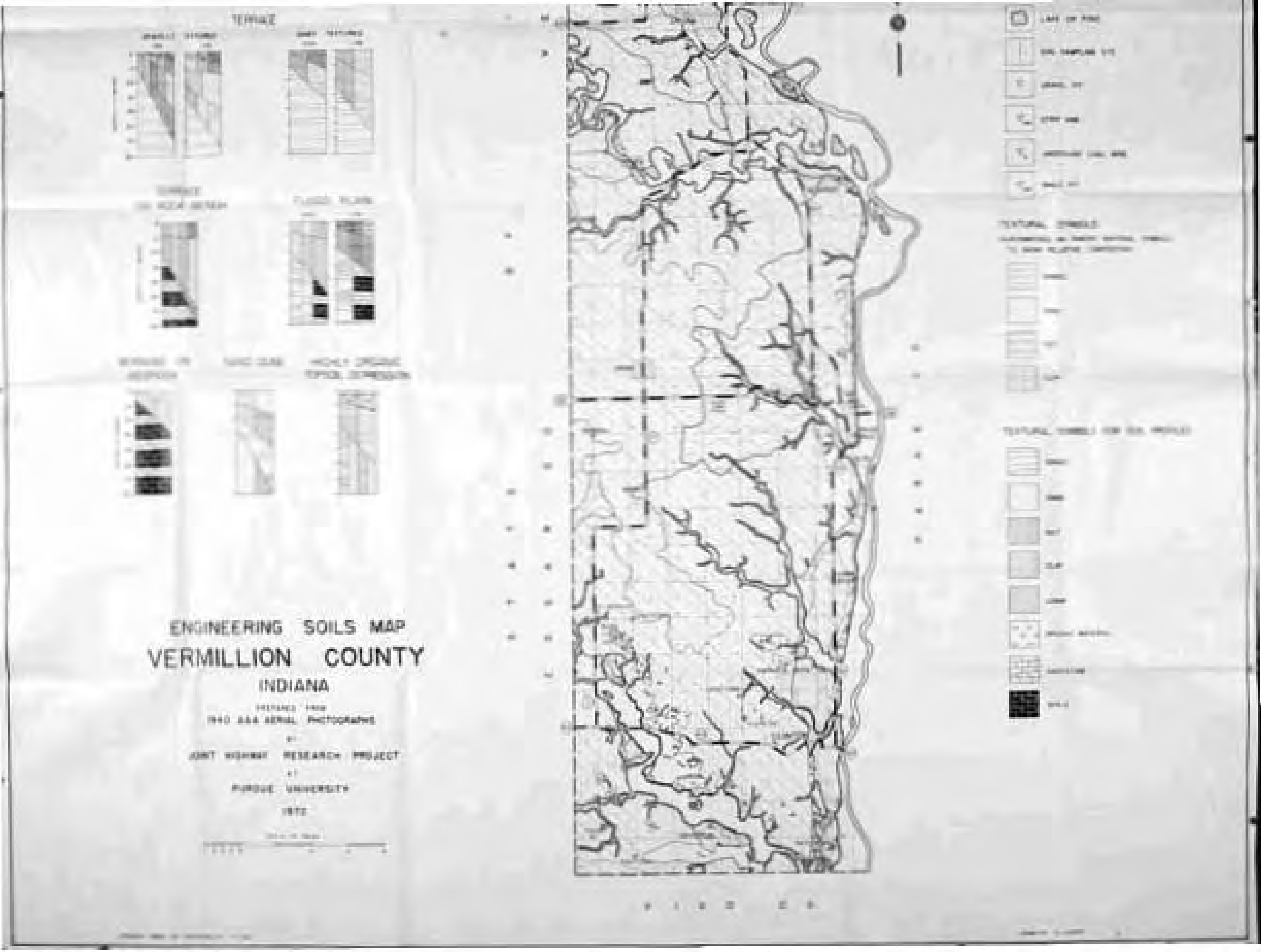

WARREN CO
GENERAL SOIL PROFILES
TERRACE
FLOOD PLAIN
MORAINE ON BEDROCK
SAND DUNE
HIGHLY ORGANIC TOPSOIL DEPRESSION
LEGEND
PARENT MATERIALS
MISCELLANEOUS
TEXTURAL SYMBOLS


TERRACE
FLOOD PLAIN
SAND DUNE
HIGHLY ORGANIC
TOPSOIL DEPRESSION
TEXTURAL SYMBOLS
TEXTURAL SYMBOLS FOR SOIL PROFILES
ENGINEERING SOILS MAP
VERMILLION COUNTY
INDIANA
PREPARED FROM
1940 AAA AERIAL PHOTOGRAPHS
BY
JOINT HIGHWAY RESEARCH PROJECT
AT
PURDUE UNIVERSITY